

REMARKS

The above amendments to the above-captioned application along with the following remarks are being submitted as a full and complete response to the Official Action dated July 18, 2006. In view of the above amendments and the following remarks, the Examiner is respectfully requested to give due consideration to this application, to indicate the allowability of the claims, and to pass this case to issue.

Status of the Claims

Claims 1-25 are under consideration in this application. Claims 1, 5 and 16 are being amended, as set forth in the above marked-up presentation of the claim amendments, in order to more particularly define and distinctly claim applicant's invention. New claims 26-28 are being added.

The claims are being amended to correct formal errors and/or to better recite or describe the features of the present invention as claimed. All the amendments to the claims are supported by the specification. Applicant hereby submits that no new matter is being introduced into the application through the submission of this response.

Prior Art Rejections

Under 35 U.S.C. §103(a), (1) claims 1-3 were rejected as being unpatentable over Kurokawa (US Patent No. 6,621,130) in view of a newly cited reference Shindo (US Patent No. 6,025,252) and Ovshinsky '219 (US Patent No. 5,335,219); (2) claim 4 was rejected over Kurokawa in view of Shindo, Ovshinsky '219 and Jachimowicz (US Patent No. 5,821,911); (3) claims 5-12 and 15 over Kurokawa in view of Shindo and Ovshinsky '219; (4) claim 13 over Kurokawa in view of Shindo, Ovshinsky '219 and Jachimowicz; (5) claim 14 over Kurokawa in view of Shindo, Ovshinsky '219, Ovshinsky' 716 (US Patent No. 5,296,716) Ovshinsky' 146 (US Patent No. 5,694,146); (6) claims 16-22 and 25 over Kurokawa in view of Shindo and Ovshinsky '219; (7) claim 23 over Kurokawa in view of Shindo, Ovshinsky '219 and Jachimowicz; and (8) claim 24 over Kurokawa in view of Shindo, Ovshinsky '219, '716 and '146. These rejections have been carefully considered, but are most respectfully traversed.

The image display device of the invention (for example, the embodiment depicted in Fig. 1), as now recited in claim 1, comprises a display section comprised of a plurality of pixels; and a control section which controls said display section. The image display device includes a nonvolatile phase-change type memory device having a memory for image display which is comprised of phase-change device elements 9 and TFTs 8 each having *only* a drain electrode connected to a corresponding one of the phase-change device elements 9 (p. 11, line 23 to p. 12, line 2; Fig. 3E shows that TET 8 and element 9 are two separate elements connected only at their electrodes; “*The memory TFT 8 is comprised of a polysilicon layer PS and a gate electrode GE with contact holes CN opened in layers overlying the polysilicon layer PS*” p. 11, last 3 lines; “*The memory element 9 is a variable resistor comprised of a chalcogenide film CH ..., one of its electrodes is connected to the memory TFT 8 via the first local interconnect LC, and the other electrode is connected to the signal line SL.*” p. 12, lines 12-17).

The invention of claim 5 further recites that the nonvolatile phase-change type memory device of claim 1 is comprised of at least one variable-resistance memory element and at least one TFT.

The invention of claim 16 further recites that the nonvolatile phase-change type memory device of claim 1 is comprised of combinations of memory cells, and each of said memory cells is comprised of one variable-resistance memory element and one TFT, and retains display data represented by one bit or more.

As recited in new claims 26-28, each of the phase-change device elements 9 is disposed to extend laterally along one side of a corresponding pixel area (p. 13, lines 5-6; Fig. 2).

The material for forming the phase-change type variable-resistance memory element 56 may be a material made chiefly of Zn and Te, a chalcogenide material containing at least one element of Te, Se and S (e.g., p. 43, 1st paragraph). “*While the ON-resistance of the memory TFT was about 500 k Ω , the phase-change type variable resistor serving as the memory element exhibited a high resistance value of about 100 M Ω in the amorphous state, thereby realizing the stable memory operation* (p. 19, lines 2-7).”

The invention provides the following advantages (p. 19, lines 8-15): (1) Continuously generating display images based on image data retained in memories of respective pixels, even after inputting and outputting of image data are discontinued by stopping the operation

of the peripheral circuits. (2) Since the memories are of the nonvolatile type, the periodic rewriting of information, which is called refreshing, is not required.

Applicants respectfully contend that none of the cited prior art references teaches or suggests such an “image display device including a nonvolatile phase-change type memory device having a memory for image display which is comprised of *phase-change device elements* and *TFTs* each having *only* a drain electrode connected to a corresponding one of the *phase-change device elements*”, as does the invention.

As admitted by the Examiner, Kurokawa’s image display device has a nonvolatile memory device for image display which is NOT comprised of TFTs (p. 2, last 2 lines of the outstanding Office Action) or phase-change device elements (p. 3, 3rd paragraph of the outstanding Office Action).

Shindo was relied upon by the Examiner to teach an image display device having a nonvolatile memory device for image display which is comprised of TFTs. Shindo concerns manufacturing a semiconductor device such as a micromachine, a solar battery, a volatile or a nonvolatile memory, a load of a memory cell of an SRAM, a field effective thin film transistor (“TFT”), etc (col. 1, lines 10-15). Shindo’s 24th Embodiment (FIG. 177) shows an MFSFET having memory cells formed by thin film transistors (TFT) provided with gate insulating films of ferroelectric substances (col. 133, lines 1-18). However, as admitted by the Examiner, Shindo also fails to teach any a nonvolatile memory device for image display comprised phase-change device elements (p. 3, 3rd paragraph of the outstanding Office Action).

Ovshinsky was relied upon by the Examiner to teach an image display device having a nonvolatile memory device for image display which is comprised of phase-change device elements. Although Ovshinsky discloses a nonvolatile phase-change type memory device, Ovshinsky merely sandwiches a layer of chalcogenide memory material 36 in-between contact layers 32, 34, 38 and 40 of carbon and molybdenum to form a memory element 30 which is deposited over a p+ regions 24 in individual ohmic electrical series contact with a diode 26 (Figs. 1-2; col. 27, lines 12-29). In other words, Ovshinsky merely provides a phase-change memory element functioning as a *memory cell* by itself in conjunction with a diode, rather than functioning as a *variable-resistance* which works with a memory cell made of TFT by connecting only with a drain electrode of the TFT as does the present invention.

In addition, Kurokawa provides a frame memory utilizing electrically erasable and programmable read only memory (EEPROM) having floating gates. Shindo discloses a solar

battery having a p-i-n structure utilizing a single-crystalline Si substrate or a memory cell including a TFT, and a method of manufacturing such a solar battery or memory. Ovshinsky provides a phase change memory for an optical memory disk, and its application. Therefore, a mere combination Kurokawa, Shindo, and Ovshinsky produces a configuration of an image display device different in structure, type, function and application from an image display device recited in the independent claims of the present invention, and the configuration obtained by the mere combination does not produce the configuration and advantages of the present invention.

Other cited prior art references fail to compensate for the deficiencies of Kurokawa, Shindo and Ovshinsky.

For example, Jachimowicz discloses a virtual image display for forming an image from light rays from a light emitting diode (LED) array on a semiconductor chip by using an optical system such as mirrors and lenses. Jachimowicz is completely different in structure, type, function and obtainable advantages, (1) from the invention of the active-matrix organic EL type display recited in claim 4, (2) from the invention of the active-matrix organic EL type display recited in claim 13, and (3) from the invention of the active-matrix organic EL type display recited in claim 23 of this application. Even if one skilled in the art were motivated to further combine Jachimowicz with the combination of the Kurokawa, Shindo, and Ovshinsky, and the mere combination of the Kurokawa, Shindo, Ovshinsky, and Jachimowicz inventions does not lead to the invention recited in claims 4, 13 and 23 of this application, or provide the advantages obtainable from the present invention.

Regarding claims 7 and 18, Ovshinsky merely discloses that “repeatable and detectable switching resistance values can be effected” (col. 25, lines 17-18), and this statement does not teach or suggest the configuration of the present invention in which the variable-resistance memory element is free from variations in resistance value due to registration errors of masks, as recited in claims 7 and 18 of this application. Therefore, the mere combination of Kurokawa, Shindo and Ovshinsky does not produce the configuration and advantages of the invention recited in claim 7 of this application.

Regarding claim 10, Kurokawa’s frame memory disclosed is configured to store data corresponding to each of the pixels. On the other hand, the present invention, as recited in claim 10, uses each of the plurality of pixels itself to store corresponding data therein. The display having pixel memories recited in claim 7 is completely different in structure, type,

function, use and obtainable advantages, from Kurokawa such that Kurokawa does not produce the configuration and advantages of the present invention.

Regarding claims 11-12, 15, 21-22, and 25 Kurokawa's memory is an EEPROM having a floating gate, which is different in structure and type, from the image display device having a frame memory comprised of phase-change type memory devices and TFTs as recited in claims 11-12 and 15.

Kurokawa, Shindo, Ovshinsky, other cited references, and their combinations fail to teach or suggest each and every feature of the present invention as recited in independent claims 1, 5 and 16 from which other claims depend. As such, the present invention as now claimed is distinguishable and thereby allowable over the prior art cited in the Office Action. The withdrawal of the outstanding prior art rejections is in order, and is respectfully solicited.

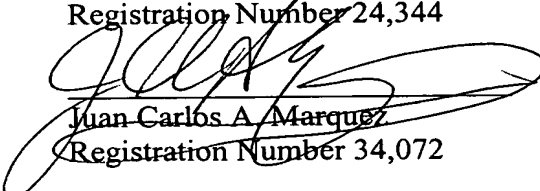
Conclusion

In view of all the above, clear and distinct differences as discussed exist between the present invention as now claimed and the prior art reference upon which the rejections in the Office Action rely, Applicants respectfully contend that the prior art references cannot anticipate the present invention or render the present invention obvious. Rather, the present invention as a whole is distinguishable, and thereby allowable over the prior art.

Favorable reconsideration of this application is respectfully solicited. Should there be any outstanding issues requiring discussion that would further the prosecution and allowance of the above-captioned application, the Examiner is invited to contact the Applicant's undersigned representative at the address and telephone number indicated below.

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